

# Torsion and Detorsion in Gastropod-II

## Effects of Torsion

Torsion or twisting is a fundamental feature of gastropods and represents their greatest departure from the ancestral molluscan plan. Spengel (1881) recognized some organizational peculiarities.

### 1. Displacement of mantle cavity

Mantle cavity was posterior in position. Ventral foot increases in length that tends to shift the mantle cavity and pallial complex away from the head. Following torsion, the mantle cavity opens just behind the head and its associated parts shift forwards.

### 2. Changes in relative positions

Before torsion, anus, ctenidia and renal orifices point backwards, and the auricles lie behind ventricle. After torsion, anus, ctenidia and renal orifices project forward, and the auricles come in front of ventricle.

Original posterior face of visceral sac becomes the actual anterior face, so that visceral organs morphologically of the original right side become placed topographically on the left side, and vice versa.

### 3. Endogastric coil

Coil of visceral sac and the shell, which primitively was dorsal or exogastric, becomes ventral or endogastric, after torsion.

### 4. Chiastoneury

Long, uncoiled pleuro-visceral nerve connectives become twisted into a fig. 8. Right connective with its ganglion passes over the intestine to become supra-

intestinal, while left connective passing underneath the intestine to become infra-intestinal.

#### 5. Looping of alimentary canal

Digestive tract, which was originally straight from mouth to anus, is thrown into a loop.

#### 6. Loss of symmetry and atrophy

Anus is displaced towards right side of the pallial cavity due to this original symmetry of organisation disappears. Paired parts of primitively left or topographically right side becomes atrophied.

Variations may be seen in some gastropods.

#### Significance of Torsion

According to Garstang (1928), torsion occurred as a larval mutation. It is advantageous to the larva adapted to pelagic life but of little direct use to the adult. Before torsion, the untwisted swimming larva fell an easy victim to its predators because the posterior mantle cavity could receive the delicate head and velum only after the foot was already inside.

After torsion, the mantle cavity became anterior, so that the sensitive parts i.e., head and velum could withdraw first followed by the foot, operculum sealed the aperture, the cilia of velum stopped beating, so that larva could fall to the sea bottom and avoid its enemies swimming in the water.

According to Morton (1958) the main advantage must be to the adult.

Firstly, torsion promotes stability in the adult by placing bulky mass of animal nearer the substratum.

Secondly, in primitive Molluscs, the mantle cavity-containing gill was situated posteriorly, so that when the animal moved upstream, the water-flow and the current due to movement of the animal opposed the respiratory current entering the mantle cavity from behind the animal.

After torsion, mantle cavity is curled anteriorly above the head, so that all the three currents now flow in the same direction, thus flushing the mantle cavity continuously with fresh clean water and increasing its ventilation.

Thirdly, anteriorly placed chemoreceptive organs (osphradia) can also continuously sample the sediment and incurrent water stream and the animal orients itself properly with the help of the sense organs on the head. Once the shell is lost, gills become exposed to external currents and their anterior position remains of no advantage.

#### Detorsion

The reversal of torsion is known as detorsion. It is very characteristic of the whole group of the Euthytreura. As a result, pallial complex travels backwards along the right side, ctenidia point backwards, auricles move behind the ventricle, and the visceral loop becomes untwisted and symmetrical. In this way, a secondary external symmetry is re-established. Torsion must be disadvantageous to adult snails, as many of them have undergone detorsion processes. Various degrees of detorsion are met within the Euthyneura. In the least specialized Opisthobranchia and Pulmonata (*Acteon*, *Bulla*, etc.), detorsion is not complete, so that the visceral loop remains partly twisted and the anus and ctenidium are directed laterally.

Total detorsion is accompanied by a reduction or disappearance of the shell as in a typical Opisthobranchia (*Aplysia*).

In extreme cases, as in *Prerotrachea*, the mantle and the visceral sac also disappear and the body elongates to become worm-like. The mantle cavity, visceral hump, external shell and even ctenidia may be lost, as in Nudibranchia (Eous, Doris, etc.). The phenomenon of detorsion can be elaborated as:

(1) In some cases the right ctenidium (originally left) and osphradium are absent.

(2) In *Eolis*, there is veliger larva with a coiled visceral hump that undergoes torsion but adults do not show any sign and the pallial complex is posteriorly placed in adult. Naturally, detorsion must have occurred during the course of development.

(3) In *Pulmonata*, the pallial complex is shifted but there is no chiastoneury as a result of shortening of visceral commissures. The pleurovisceral mass and so the chiastoneury is secondarily lost.